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APPRENTICESHIP TRAINING

GASFITTER Program

Alberta

CAREER DEVELOPMENT AND EMPLOYMENT
Apprenticeship and Trade Certification

7451970

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GASFITTER TRADE

THE GOAL OF APPRENTICESHIP TRAINING

To develop a competent tradesman who, through skill and knowledge, is capable of producing with accuracy and precision the scope of work and services covered by the gasfitting industry.

THE PRODUCT OF APPRENTICESHIP—
a graduate who is able to:

*Know the standards and regulations of natural and L.P. gas in order to provide the maximum of safety.

*Know the characteristics and proper use of each product.

*Install and maintain pipe systems and equipment using natural or propane gas.

*Be proficient in the safe use and maintenance of hand and power tools.

*Read and carry out directions as given on sketches and plans.

*Be familiar with the work of other tradesmen in the construction industry.

GASFITTER
APPRENTICESHIP INFORMATION

Basic Requirements:

*Indenture for three periods of Trade experience and training.

*Attend an eight week technical training course in the first period and an eight week technical training course in the third period.

*Fulfill the requirements for each period including 1800 hours of work experience inclusive of time spent at the training course; successfully complete the technical training course and obtain a satisfactory employer's report.

*Education — a minimum requirement is the completion of grade 9 or a pass on an equivalent entrance examination as prescribed by the Trade regulation.

*Age — the minimum age for apprentices is 16 years. There is no upper age limit.

Credits:

*Accelerated patterns of apprenticeship may be granted for related technical training and/or experience.

Benefits:

*Apprenticeship is a learning-while-earning program. While working at the trade during apprenticeship, apprentices are assured by regulation of a minimum percentage of journeyman rate; 50% during first period, 60%, during second period, 80% during third period. Progress from one rate to the next takes place only after successful completion of all the requirements for each period.

*All apprentices 17 years of age and older are normally eligible for training allowances while attending technical training courses. These allowances are funded by the Canada Employment and Immigration Commission.

*Administrative procedures establishing the amount of training allowance is complex and can vary with an individual's circumstances. Contact a local Canada Employment Centre for details.

*An apprentice who successfully completes the program will graduate with an Alberta Completion of Apprenticeship Certificate and a Certificate of Proficiency.

*The most significant benefit to the graduate apprentice is that he is well trained in technical and practical aspects of the trade and is able to make a worthwhile and productive contribution to society. Society in return, will provide an opportunity for an above-average income and successful livelihood.

DIRECTIONS FOR PROSPECTIVE APPRENTICES

*Contact your nearest Apprenticeship and Trade Certification Office for detailed information and counselling (see list of offices on page 34).

*Obtain application forms in duplicate from the Apprenticeship and Trade Certification Office and neatly complete, on both copies, the information requested from the apprentice.

*Contact in person firms that employ Gasfitters and apply for an apprentice position. Present your apprentice application forms to the person who interviews you so that he will know who you are and what you can offer his firm.

*Persevere in the search for apprentice employment and upon obtaining employment, leave the application with the employer.

*Attach to the apprentice application a copy (transcript) of the marks for your last year of school. Applicants who do not have their school transcripts or a grade nine standing are required to write an entrance examination. If transcripts have been lost, contact Alberta Education for information on school transcripts.

*Any time credit, for previous experience in the Gasfitter trade, should be discussed with the employer and requested on the application forms by the employer.

*A contract of apprenticeship is entered into between the apprentice and the employer and should be signed within three months after the apprentice applications have been approved. If contracts have not been issued within this time, contact the Apprenticeship and Trade Certification Office.

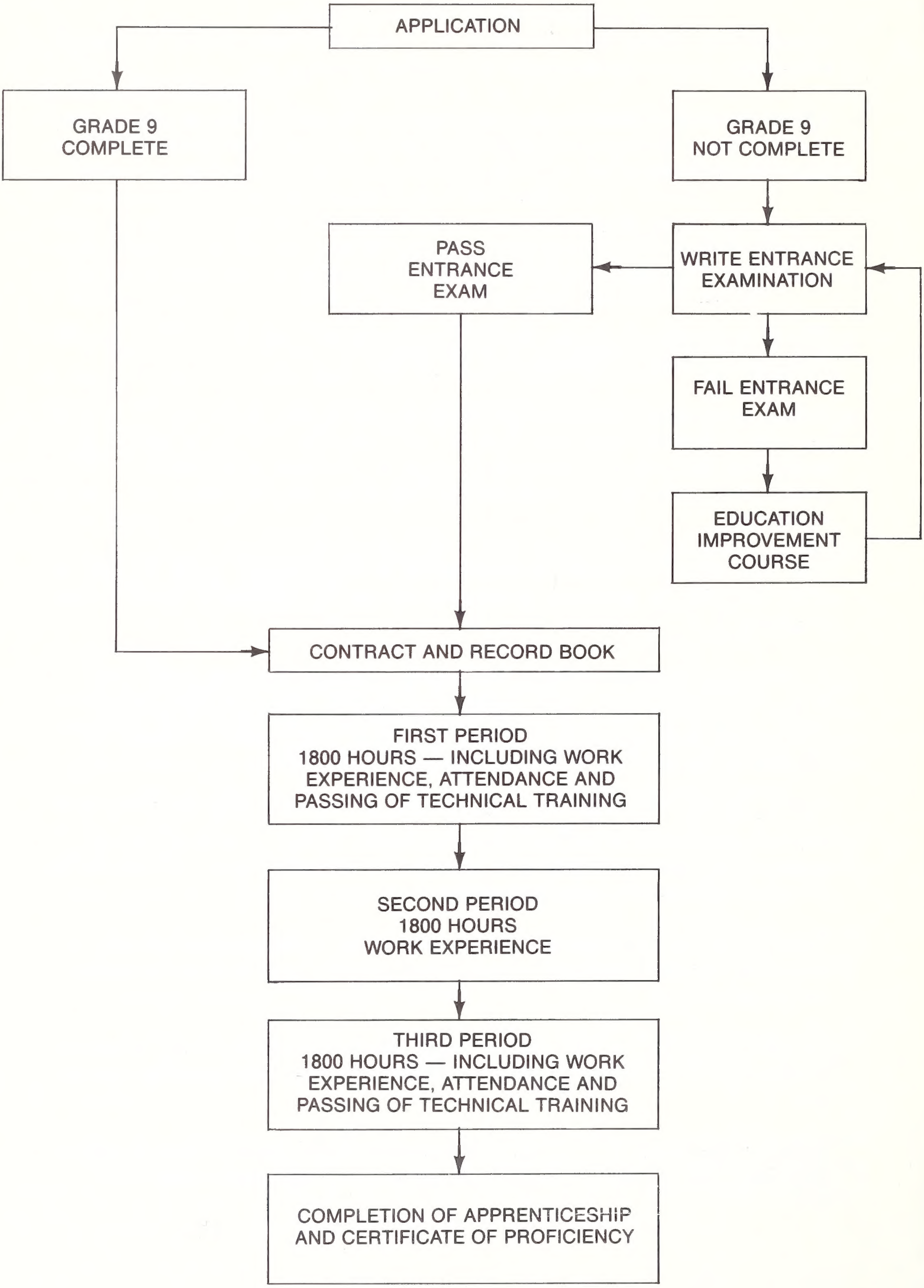
*Before signing the contract of apprenticeship read the complete document carefully — know your obligations and responsibilities to your employer — know the employer's obligations and responsibilities to you — feel confident you have selected the right occupation.

*Know when you will be expected to attend classes and be prepared to attend. School schedules will be sent to your employer and notice to attend classes will be sent to you.

*Prepare in advance for the financial obligations required of you during school training. Reference materials and school supplies are paid for by the apprentice.

*While an apprentice, it will be your responsibility to respond promptly to mailed directions and requests from Apprenticeship and Trade Certification.

APPRENTICESHIP ROUTE TOWARD CERTIFICATION


APPLICATION
GRADE 9 COMPLETE
GRADE 9 NOT COMPLETE
WRITE ENTRANCE EXAMINATION
PASS ENTRANCE EXAM
FAIL ENTRANCE EXAM
EDUCATION IMPROVEMENT COURSE
CONTRACT AND RECORD BOOK
FIRST PERIOD 1800 HOURS — INCLUDING WORK EXPERIENCE, ATTENDANCE AND PASSING OF TECHNICAL TRAINING
SECOND PERIOD 1800 HOURS WORK EXPERIENCE
THIRD PERIOD 1800 HOURS — INCLUDING WORK EXPERIENCE, ATTENDANCE AND PASSING OF TECHNICAL TRAINING
COMPLETION OF APPRENTICESHIP AND CERTIFICATE OF PROFICIENCY

APPRENTICESHIP COMMITTEE STRUCTURE

Gasfitter Provincial Apprenticeship Committee

The Provincial Apprenticeship Committee for the Gasfitter Trade is comprised of members from Local Apprenticeship Committees from the cities of Edmonton and Calgary.

This Committee is concerned with the policies that guide the program and make recommendations to the Apprenticeship and Trade Certification Board and the Executive Director of Apprenticeship and Trade Certification in the following areas:

*Contribute current information relative to changes in the trade and requirements of industry.

*Make recommendations for changes to existing trade regulations.

*Assist in updating of the training program through recommendations for revisions to the course outline and attendant examinations.

Gasfitter Local Apprenticeship Committee

Local Apprenticeship Committees are concerned with individuals and trade situations within a local region. Meetings are held throughout the year to make recommendations and to discuss problems relating to the apprenticeship program. Members who serve on committees are nominated by employer and labour organizations, and membership is equally divided into employer and employee representation in accordance with The Manpower Development Act.

Apprenticeship Committee Members:

Mr. M. Ball — Edmonton — Employer
Mr. J. Osland — Edmonton — Employer
Mr. A. Taylor — Edmonton — Employee
Mr. L. Hambling — Edmonton — Employer (Alternate)
Mr. R. McRae — Edmonton - Employee
Mr. P. Bass — Calgary — Employer
Mr. A. Martineau — Calgary — Employer
Mr. G. Leigh — Calgary — Employer (Alternate)
Mr. A. Ohlhauser — Calgary — Employee (Alternate)
Mr. M. McCaghreen — Calgary — Employee (Alternate)

GASFITTER PROGRAM
COURSE OUTLINE

This outline has been prepared in accordance with recommendations from the Provincial Apprenticeship Committee for the Gasfitter Trade in the Province of Alberta.

The outline was updated following consideration given to recommendations and suggestions from:

Local Apprenticeship Committees
Representatives from training institutes
Curriculum Sub-Committee from the Provincial Apprenticeship Committee

PROCEDURES FOR RECOMMENDING REVISION(S) TO THE COURSE OUTLINE

Any concerned citizen or group in the Province of Alberta may make recommendations for change by writing to Apprenticeship and Trade Certification, Edmonton.

It is requested that recommendations for change refer to specific areas and state references used. Recommendations received will be placed before regular meetings of the Provincial Apprenticeship Committee.

GASFITTER PROGRAM

Subjects and Time Distribution

First Period	**8 Weeks**	**30 Hours Per Week**	**240 Hours**
Section One:	Trade Mathematics		22
Section Two:	Basic Blueprint Reading		15
Section Three:	Trade Science		28
Section Four:	General Piping		45
Section Five:	Combustion and Venting		26
Section Six:	Burners		10
Section Seven:	Appliances		10
Section Eight:	Regulators, Meters, Controls and Gauges		20
Section Nine:	Shop Work		64

Third Period	**8 Weeks**	**30 Hours Per Week**	**240 Hours**
Section One:	Trade Mathematics		10
Section Two:	Blueprint Reading		12
Section Three:	Combustion and Venting		32
Section Four:	Storage and Heaters		16
Section Five:	Carburetion/Conversion		30
Section Six	Appliance Installation and Gas Line Sizing		38
Section Seven:	Controls		38
Section Eight:	Shop Work		64

FIRST PERIOD TECHNICAL TRAINING

SECTION ONE: TRADE MATHEMATICS SI/IMPERIAL 22 Hours

A. Review of Simple Arithmetic **2 Hours**

1. Addition, subtraction, multiplication and division of
   (a) whole numbers
   (b) decimals
   (c) fractions

B. Conversions **2 Hours**

1. Fraction to decimals
2. Decimals to fractions
3. Decimal feet to feet inches inches, fractional inches

C. Perimeters **2 Hours**

1. Rectangles
2. Triangles
3. Circles

D. Areas **2 Hours**

1. Rectangles
2. Triangles
3. Circles

E. Volumes **2 Hours**

1. Cubes
2. Cylinders
3. Hemispheres
4. Spheres

F. Capacity **1 Hour**

1. Cubic metres
2. Litres
3. Cubic feet
4. Imperial gallons
5. U.S. gallons
6. Mass

G. Surface Areas **2 Hours**

1. Cubes
2. Cylinders
3. Hemispheres
4. Spheres
5. Semi Ellipsoidal

H. Temperature Conversions **1 Hour**

1. Celsius to Fahrenheit
2. Fahrenheit to Celsius

I. Percentages **2 Hours**

1. Conversion of fractions to percent
2. Conversion of decimal to percent
3. Percentages of wages, profits and costs
4. Chain discounts
5. Inputs and outputs
6. Calculations of free areas of grills

J. Heat **2 Hours**

1. Specific heat capacity of water
    (a) metric
    (b) imperial
2. Calculation of heat requirements for water and air
    (a) Btu's
    (b) Joules

K. Offsets **4 Hours**

1. Parallel
2. Rolling
3. Equal spread
4. Unequal spread

SECTION TWO: BLUEPRINT READING SI/IMPERIAL 15 Hours

A. Scales **1 Hour**

1. Metric-residential and commercial
2. Imperial-residential and commercial

B. Basic Symbols **2 Hours**

1. Fitting in straight line
   - (a) ninety degree elbows
   - (b) tees
2. Flanges
   - (a) weld-neck in single line
   - (b) slip-on in single line
3. Valves
   - (a) globe
   - (b) gate
   - (c) plug cock
   - (d) ball
   - (e) motorized
   - (f) internal safety control
4. Basic line symbols for the mechanical trades

C. Legends **1 Hour**

1. The interpretation of mechanical legends

D. Orthographic Projection **1 Hour**

1. Front view
2. Side view
3. Top view

E. Orthographic Projections of Pipe **2 Hours**

1. Front view
2. Side view
3. Top view

F. Isometric Pipe Drawings **2 Hours**

G. Residential Blueprint Reading **6 Hours**

1. Plot plans
2. Elevations
3. Sections
4. Details

SECTION THREE: TRADE SCIENCE 28 Hours

A. Matter **2 Hours**

1. Definition
2. Elements — compounds and mixtures

3. States of matter
4. Properties of matter
5. Physical changes
6. Chemical changes

B. Density — (SI/Imperial) **1 Hour**

1. Definition
2. Water
3. Air
4. Methane
5. Propane

C. Relative Density (Specific Gravity) **1 Hour**

1. Definition
2. Methane
3. Propane
4. Mercury

D. Adhesion and Cohesion **1 Hour**

1. Definitions
2. Reading of water and mercury manometers

E. Capillarity **1 Hour**

1. Definition
2. Use of wetting agents
3. Conditions required for maximum use

F. Bouyancy **1 Hour**

1. Definition
2. Principles of floatation

G. Pressure **3 Hours**

1. Definition
2. Hydrostatics
3. Principles of hydrostatic pressure
4. Inter-Conversion of inches W.C. to ounces of pressure and P.S.I. — P.S.I. to inches and inches to P.S.I.

5. Pascal kPa
6. Conversion of water column to kPa
7. P.S.I.

H. Atmosphere **3 Hours**

1. Constituents of the atmosphere
2. Pressure exerted
3. Effect of altitude on pressure
4. Gauge pressure
5. Absolute pressure
6. Vacuum
7. Conversion of mm mercury to kPa
8. Boyles Law — Compressibility of Gases — introduction only

I. Temperature **3 Hours**

1. Fahrenheit
2. Celsius
3. Conversion
4. Absolute temperature, introduction to Charles' Law

J. Heat **4 Hours**

1. British Thermal Units
2. M.B.H. & Therms
3. Giga joules
4. Kilowatts
5. Sensible heat
6. Latent heat and specific enthalpy
7. Total heat
8. Heat of fusion for water (metric and imperial)
9. Heat of vaporization for water (metric and imperial)

K. Heat Transfer **1 Hour**

1. Conduction
2. Convection
3. Radiation

L. Expansion and Contraction — 1 Hour

1. Effects on solids and liquids
2. Coefficients of linear expansion
3. Bimetal strips
4. Liquid expansion controls

M. Electricity — 3 Hours

1. Electron flow
2. Amps, volts, ohms
3. Direct current
4. Alternating current
5. Electrical circuits
6. Magnetism
7. Ohm's law
8. Provisions for solid state fundamentals, transistors, thermistors

N. Properties of Gases and Liquids — 3 Hours

1. Natural gas
    - (a) chemical symbol
    - (b) relative density
    - (c) heating value
    - (d) operating pressure
    - (e) allowable pressure drop
    - (f) odoration
2. LP — Gases
    - (a) chemical symbols
    - (b) heating value interconversion
    - (c) latent heat of vaporization
    - (d) liquid to vapor ratio
    - (e) operating pressures
    - (f) allowable pressure drop
    - (g) boiling points
    - (h) odoration

SECTION FOUR: GENERAL PIPING — 45 Hours

A. Steel Pipe — 5 Hours

1. Terminology, types and grades
2. Standard sizes
3. Wall thickness and pressure ratings

4. Taking and reading pipe measurements
    - (a) end to end
    - (b) end to centre
    - (c) centre to centre
5. Cutting pipe and nipples
    - (a) importance of reaming pipe
6. Cutting oil and lubricants
7. Treading
    - (a) hand tools
    - (b) power tools
8. Designation of standard pipe and tubing fittings
9. Welded joints — bevelling and fitting
10. Weld — fittings
11. Black malleable and galvanized

B. Tube and Tubing, Copper, Aluminum, Steel, Brass **4 Hours**

1. Terminology, types, grades
2. Standard sizes
3. Wall thickness
4. Solder — (copper tube)
5. Silver brazing
6. Solder fittings
7. Flared fittings
8. Compression fittings

C. Hoses **1 Hour**

1. Types
2. Uses
3. Specifications

D. Thermoplastics (Introduction) **2 Hours**

1. Terminology
2. Sizes
3. Pressure rating

E. Valves **2 Hours**

1. Recognition and use of basic valves
    - (a) gate
    - (b) globe

    - (c) plug cocks
    - (d) ball
    - (e) concentric
  2. Pressure ratings

F. Hangers — 1 Hour

1. Types of hangers and supports
2. Specific uses of each type
3. Spacing
4. Fasteners and inserts

G. Powder Activated Tools — 6 Hours

1. Course as currently provided by the technical institutes
2. Types of powder activated tools
3. Uses and application
4. Care, maintenance and operation
5. Practical experience in firing
6. Safety
    - (a) general
    - (b) regulations

H. Rigging — 10 Hours

1. Parts of a rope
    - (a) fibres
    - (b) strands
    - (c) running end
    - (d) standing part
    - (e) bight
2. Basic knots
    - (a) figure eight
    - (b) square
    - (c) clove hitch
    - (d) timber hitch
3. Steel ropes
4. Proper slings
5. Crane operation
6. Safety
    - (a) maximum loads
    - (b) use of safety belts
    - (c) lifts
    - (d) general
    - (e) regulations

I. Pumps **8 Hours**

1. Reciprocating pumps
    - (a) operating principle
    - (b) suction and discharge heads
    - (c) applications
    - (d) maintenance
2. Centrifugal pumps (turbine)
    - (a) operating principle
    - (b) effects on suction and discharge heads
    - (c) cavitation
    - (d) maintenance
3. Positive displacement rotary pumps
    - (a) types
        - (i) gear
        - (ii) vane
    - (b) operating principle
    - (c) maintenance

J. Plastic Pipe **6 Hours**

(certificate Program)

SECTION FIVE: COMBUSTION AND VENTING 26 Hours

A. Principle of combustion and venting **10 Hours**

1. Common combustion terms
2. Products of combustion
    - (a) complete
    - (b) incomplete
3. Air requirements
    - (a) primary
    - (b) secondary
4. Range of flammability
    - (a) natural gas
    - (b) propane
5. Appliance adjustments and conversions
6. Code interpretation

B. Venting **15 Hours**

1. Draft hood
    - (a) purpose
    - (b) types
    - (c) locations

2. Flue collar
   - (a) high and low altitude connections

3. Vent connectors
   - (a) acceptable materials
   - (b) installation
   - (c) minimum clearance

4. Vents
   - (a) venting principles and applications
   - (b) acceptable materials
   - (c) installation
   - (d) temperature ranges
   - (e) minimum clearance
   - (f) terminations
   - (g) sizing — rule of thumb

5. Chimneys
   - (a) venting principles and applications
   - (b) types
   - (c) installation
   - (d) temperature ranges
   - (e) minimum clearances
   - (f) termination

6. Code interpretation

C. Air Supply — 1 Hour

1. Requirement for ventilation, combustion and draft hood dilution

2. Grill and duct sizing for residential

3. Location of grills

SECTION SIX: BURNERS — 10 Hours

A. Burners

1. Atmospheric burners
   - (a) inshot
   - (b) upshot

2. Parts of a burner

3. Orifice
   - (a) types
   - (b) sizing — natural and propane
   - (c) drilling
   - (d) dual fuel orifice setting
   - (e) testing

4. Types of flame
   - (a) aerated
     - (i) neutral

        - (ii) oxidizing
        - (iii) carbonizing
    - (b) non-aerated

5. Pilot burners
    - (a) function
    - (b) types
        - (i) aerated
        - (ii) non-aerated
    - (c) proper location
    - (d) effective ignition tests
    - (e) control terminology of pilots
        - (i) continuous
        - (ii) intermittent
        - (iii) interrupted
        - (iv) proved
        - (v) expanding pilot

SECTION SEVEN: APPLIANCES 10 Hours

A. Rating of Appliances 2 Hours

1. Approval agencies

2. Ratings
    - (a) inputs
    - (b) outputs
    - (c) altitude ratings

B. Appliance Installation 8 Hours

1. Approval of appliances

2. Basic requirements

3. Installation requirements
    - (a) suitability of use
    - (b) locations
    - (c) connections
    - (d) clearances
    - (e) accessibility
    - (f) responsibility
    - (g) damaged and used appliances
    - (h) appliances protected by fire extinguisher systems
    - (i) self energizing pilot systems
    - (j) electrical components
    - (k) appliances in garages
    - (l) outdoor installation
    - (m) duct work connections

4. Specific appliances
    - (a) counter appliances

- (b) ranges
- (c) furnaces
- (d) unit heaters
- (e) service water heaters
- (f) hot plates
- (g) clothes dryers
- (h) room heaters
- (i) decorative appliances
- (j) direct vent appliances
- (k) direct fired units
  - (i) construction heaters
  - (ii) make up air

SECTION EIGHT: REGULATORS, METERS, CONTROLS AND GAUGES 20 Hours

A. Regulators 2 Hours

1. First stage
   - (a) operating principle
   - (b) installation
2. Second stage
   - (a) operating principle
   - (b) sizing
   - (c) installation
   - (d) venting
   - (e) common problems
3. Appliances
   - (a) installation
   - (b) venting
   - (c) setting

B. Gas Meters 2 Hours

1. Operating principle
2. Use of test dials
3. Reading
4. Converting to:
   - (a) Btuh
   - (b) watts
5. Reading of high pressure gas meters conversion factor for pressure
   - (a) converting cubic feet to Btu's
   - (b) converting cubic metres to watts

C. Controls 14 Hours

1. Thermocouples
   - (a) principle of operation

   - (b) installation
   - (c) testing

2. Safety valves
   - (a) types
   - (b) safe hook ups — 100%
   - (c) installation

3. Safety switches
   - (a) types
      - (i) safe hook up
      - (ii) 100% hook up
   - (b) principle of operation
   - (c) installation

4. Gas valves
   - (a) diaphragm
      - (i) operating principle
      - (ii) installation
      - (iii) venting
      - (iv) ambient temperature limits
         - — coil operating temperature
         - — environmental temperature
   - (b) solenoid
      - (i) operating principle
      - (ii) installation
      - (iii) specialized coils
      - (iv) ambient temperature limits
         - — coil operating temperature
         - — environmental temperature
   - (c) heat motor
   - (d) combination gas valves
   - (e) hydro motor — motorized

5. Room thermostats
   - (a) sensing devices
   - (b) anticipators
   - (c) voltages
   - (d) installation
   - (e) programming type thermostats

6. Fan switches
   - (a) sensing devices
   - (b) combination fan and limits
   - (c) setting

7. Limit controls
   - (a) forced air furnace
   - (b) steam boilers
   - (c) hot water boilers
   - (d) manual reset limits

D. Gauges — 2 Hours

1. Manometers
    - (a) correct usage
    - (b) direct and indirect reading
2. Pressure gauges
    - (a) care and use
    - (b) low pressure gauges
    - (c) test pressure gauges

SECTION NINE: SHOP WORK — 64 Hours

A. Shop Program — 4 Hours

1. Instruction in correct use of hand tools and power tools as related to shop program
2. Emphasis, at all times to be placed on
    - (a) good workmanship
    - (b) sound piping practice
    - (c) safety

B. Steel Pipe — 6 Hours

1. Measuring, cutting, reaming and threading of pipe
2. Proper use of a nipple chuck in making nipples
3. Make up joints, correct length and proper fit
4. Safety
    - (a) general
    - (b) regulations

C. Fabricating Welded Piping Systems — 12 Hours

1. Cutting
2. Bevelling
3. Fabricating steel pipe and welding fittings
4. Safety
    - (a) general
    - (b) regulations

D. Aluminum, steel, copper, brass — 12 Hours

1. Measuring, cutting and reaming
2. Proper techniques for copper
    - (a) soft soldering
    - (b) flared
    - (c) compression

3. Proper use of bending tools and simple bends
    - (a) 45°
    - (b) 90°
    - (c) 180°
    - (d) use of gain

4. Safety
    - (a) general
    - (b) regulations

E. Silver Brazing — 6 Hours

1. Use of easy flow

2. Use of silfos

3. Fluxes

4. Safety
    - (a) general
    - (b) regulations

F. Pressure analysis — 4 Hours

1. Proper use of water manometers
    - — standing pressure
    - — operating pressure
    - — differential pressure

2. Allowable pressure drops

3. Adjustment of regulators

4. meter clocking

5. pressure regulator settings

G. Ignition and pilot location testing — 4 Hours

1. Lighting — smooth ignition
    - — effective ignition
    - — turn down test

2. Use of adjustable orifice on burners to show flame characteristics

3. Meter clocking

H. Thermocouple Analysis — 4 Hours

1. Use of millivolt meter for testing thermocouples
    - (a) open tests
    - (b) closed tests
    - (c) drop out points
    - (d) response times
    - (e) turn down tests
    - (f) safety shut down test

I. Orifice Sizing **4 Hours**

1. Calculating orifice sizes (use of tables)
2. Sizing and drilling for specific ratings

J. Wiring **2 Hours**

1. Basic wiring circuits
   (a) series
   (b) parallel

K. Wiring **6 Hours**

1. Wiring of 24 volt gas controls
   (a) 100% safety and safe hookups using safety gas valves or safety switch
   (b) safety valve
   (c) limits
2. Wiring of Millivolt circuits

THIRD PERIOD TECHNICAL TRAINING

SECTION ONE: TRADE MATHEMATICS SI/IMPERIAL 10 Hours

A. Review of Basic Mathematics **4 Hours**

B. Calculation of Cut Lengths **2 Hours**

1. Welded pipe
2. Screwed pipe

C. Grade and Elevations **4 Hours**

1. Metric elevations
   (a) geodetic
   (b) architectural
2. Imperial elevations
   (a) geodetic
   (b) architectural
   (c) abreviated geodetic
3. Metric grades
   (a) per cent grade
4. Imperial grades
   (a) fraction of inch per foot
   (b) per cent grade

SECTION TWO: BLUEPRINT READING SI/IMPERIAL 12 Hours

A. Orthographic Pipe Projections of 45° Elbows **2 Hours**

1. Front view
2. Side view
3. Top view

B. Isometric Pipe Drawings of 45° Elbows **2 Hours**

C. Orientation of Orthographic Drawings to Isometric Spools **2 Hours**

1. Dimensioning
2. Sizing
3. Material list

D. Reading of Commercial Blueprints — 6 Hours

1. Architectural
   - (a) plot plan
   - (b) floor plans
   - (c) roof plans
   - (d) elevations
   - (e) sections
   - (f) details

2. Structural
   - (a) foundation plan
   - (b) floor plans
   - (c) sections
   - (d) details

3. Mechanical
   - (a) plot plan
   - (b) floor plans
   - (c) mechanical room plan views
   - (d) mechanical room sections

4. Mechanical details

5. Specifications
   - (a) architectural
   - (b) mechanical

SECTION THREE: COMBUSTION AND VENTING — 32 Hours

A. Combustion — 16 Hours

1. Review of material as covered in first period training

2. Combustion properties of fuel gases
   - (a) range of flammability
   - (b) air requirements

3. Appliance efficiency
   - (a) input (metric and imperial)
   - (b) output (metric and imperial)
   - (c) factors effecting efficiency

4. Combustion analysis
   - (a) setting appliances for maximum efficiency
   - (b) testing for CO, CO_2 and O_2
   - (c) use of combustion analysis kits

B. Venting — 16 Hours

1. Review of material as covered in first period training

2. Code application as it relates to
   - (a) vents

  - (b) chimneys
  - (c) vent connectors
  - (d) vent and chimney termination
  - (e) induced draft
  - (f) power exhauster

3. Sizing
   - (a) review of sizing by rule of thumb

4. Sizing by tables
   - (a) chimneys
   - (b) vents
   - (c) vent connectors
   - (d) barometric draft controls

5. Air supply
   - (a) grills
     - (i) calculation of free area
     - (ii) location
     - (iii) sizing
   - (b) duct sizing
     - (i) horizontal
     - (ii) vertical
     - (iii) confined and unconfined spaces

SECTION FOUR: STORAGE AND HEATERS 16 Hours

A. Propane Storage 15 Hours

1. Terminology of
   - (a) water capacity
   - (b) tare weight (mass)
   - (c) filling density
   - (d) gross weight (mass) as applicable to cylinders only
   - (e) the markings on propane storage tanks and cylinders

2. Valves and accessories on cylinders and tanks

3. Installations, requirements and distances
   - (a) tanks and buildings
   - (b) cylinders and buildings
   - (c) tanks on multi-tank installations

4. Filling densities of propane tanks and cylinders

5. Rate of discharge from safety relief valves (introduction, pressure rating)

6. Effects of temperature and pressure on propane gas

7. Vaporization capacity of tanks and cylinders

8. Vaporizors
   - (a) types

    - (b) capacities
    - (c) installation

9. Liquid withdrawal tanks
10. Vertical and horizontal tanks
11. Transportation of cylinders
12. Filling plants — Bulk service, Customer Services, Motor Fuel Service and Piping
13. Testing tanks and cylinders
    — Re-inspection of cylinders and tanks
14. Code regulations
15. Safety
    - (a) general
    - (b) regulations

B. Construction heaters **1 Hour**

1. Low pressure
2. High pressure
3. Installation/location
4. Safety
    - (a) general
    - (b) regulations

SECTION FIVE: CARBURETION/CONVERSION 30 Hours

A. Propane and compressed natural gas **28 Hours**

1. Properties of L.P.G. as a motor fuel
2. Fuel and carburetion
3. Installation of fuel tanks
4. Principles of engine operation
5. Air cleaners
6. P.C.V. systems — positive crankcase ventilation systems
7. Governors
8. Pollution control devices
9. Operating temperature
10. Pre-conversion checks — conversion procedures — ignition timing — spark plugs — setting/testing — exhaust analysis — trouble shooting — preventative maintenance

11. Motor fuel dispensing **2 Hours**

12. Safety
    - (a) general
    - (b) regulations

SECTION SIX: APPLIANCE INSTALLATION AND GAS LINE SIZING 38 Hours

A. Appliance Installation 22 Hours

1. Review of specific appliances as covered in first period training

2. Completion of specific appliance installations
    - (a) construction heaters
    - (b) direct fired door air heaters
    - (c) boilers
    - (d) pressure booster
    - (e) carbon dioxide generators
    - (f) direct fired make up air units
    - (g) incinerators
    - (h) lighting
    - (i) commercial appliances
    - (j) refrigerators
    - (k) stationary gas engines
    - (l) swimming pool heaters
    - (m) infra-red heaters
    - (n) roof top units

3. Safety
    - (a) general
    - (b) regulations

B. Gas Line Sizing 16 Hours

1. Familiarization with code regulations for gas line sizing
    - (a) minimum
    - (b) maximum
    - (c) allowable pressure losses
    - (d) minimum capacities

2. Calculating the proper size of pipe for a gas installation
    - (a) low pressure
    - (b) high pressure — industrial lines
    - (c) high pressure between first and second storage regulators

3. Calculating the volume of gas passing through a gas line

4. Calculating the developed length of a gas line

SECTION SEVEN: CONTROLS 38 Hours

A. Review of material as covered in first period training 3 Hours

B. Rod and Tube Thermostats **2 Hours**

1. Operating principle
2. Snap acting
3. Modulating
   (a) by-pass settings
   (b) minimum flame
4. Installation
5. Setting

C. Liquid Bulb Thermostats **4 Hours**

1. Operating principle
2. Snap acting
3. Modulation
   (a) by-pass settings
   (b) minimum flame
4. Installation
5. Setting

D. Liquid Filled Gas Pilots **2 Hours**

1. Operating principle
2. Electric ignition for liquid filled pilots
3. Safe hook ups
4. 100% shut off hook ups

E. Thermopiles, Thermocouples **4 Hours**

1. Types
2. Operating principle
3. Power output ranges
4. Usage
5. Testing
6. Response times

F. Transformers **1 Hour**

1. Operating principle
2. Voltage ranges
3. Capacity
4. Correct sizing

G. Appliance Controls **2 Hours**

1. Review of controls in basic course
2. Specific controls on gas appliances and equipment

H. Theory of Electricity for Gas Appliances **10 Hours**

1. Fundamentals — Electrostatics — Electron theory — static charges
2. D.C. circuits and symbols
    (a) Ohm's Law
    (b) Watts
    (c) Kirchoff's Volt Law
    (d) Kirchoff's Current Law
3. A.C. inductance, reactance, impedance, capacitance
4. Magnetism — Gauss/Flux — permeability, reluctance
5. Inductance generators, alternators
6. Motors
    (a) types
    (b) checks
7. Motor contactors, start controls, C/F switches, thermal overload, multi-speed
8. Electrical circuits and controls
    (a) heating
    (b) cooling
    (c) combination
9. Wiring diagrams
10. Safety

I. Flame Guard Safety and Control Systems **6 Hours**

1. Flame rods
2. Rectifying Photo cells
3. Ultra violet detectors
4. Infrared
5. Spark Ignition

J. Pressure Regulators — review of basic and correct sizing first and second stage **4 Hours**

SECTION EIGHT: SHOP WORK 64 Hours

A. Rod and Tube Thermostats **6 Hours**

1. Calibrating
2. Adjusting

3. Testing of thermocouples
4. Analysis with and without energy cut off
5. Conversion natural to propane orifice sizing

B. Liquid Bulb Thermostats **4 Hours**

1. Calibrating
2. Setting of bypass
3. Adjusting flame sets
4. Conversion natural to propane
5. Expanding pilots

C. Thermopiles **4 Hours**

1. Operation
2. Testing
3. Effective ignition

D. Wiring **10 Hours**

1. Thermopile systems
    - (a) safe systems
    - (b) 100% safety systems
2. 24 volt systems
    - (a) safety switches
    - (b) safety valves
    - (c) aquastats
    - (d) pressure switches
    - (e) limits (high and low)
3. Flame safeguards, spark ignition, electronic ignition, photocell, flue dampers, propane carburation
4. Interpretation of manufacturers drawings

E. Combustion Analysis **8 Hours**

1. Proper setting of primary air secondary and excess air
2. Effect of filters — duct — fan speeds — electric filters
3. Testing for CO, O_2, combustibles

F. Liquid Filled Pilots **2 Hours**

G. Flame Guard Safety and Control Systems **14 Hours**

1. Flame rods
2. Rectifying photocells

3. Ultra violet detectors
4. Infrared
5. Spark ignition
6. Glow coils
7. Piezzo electrics
8. Transformers

H. Uses of electrical test equipment (meters) 8 Hours

1. Continuity testing
2. Measurement of volts, amps, ohms-resistance, micro amps, milliamps
3. Interpretation of wiring diagrams

I. Electricity for gas appliances: 8 Hours

1. Electrical motors
   — motor speeds
   — motor switches — start — overload
   — circulating pumps

SUGGESTED REFERENCE MATERIALS

CSA Standard B149.1

CSA Standard B149.2

Information Sheets — Training Institutes

Service Manuals — Honeywell Control Co.

Service Manuals — General Control Co.

L.P. Gas Manuals — Fisher Manufacturing Co.

L.P. Gas Manuals — Rego

TECHNICAL TRAINING SCHOOLS

The Gasfitter apprenticeship training program is offered by Alberta Career Development and Employment, Apprenticeship and Trade Certification. Staff and facilities for teaching the program are supplied by:

1. Northern Alberta Institute of Technology
2. Southern Alberta Institute of Technology

LOCATION OF APPRENTICESHIP AND TRADE CERTIFICATION REGIONAL OFFICES

BONNYVILLE

CALGARY

EDMONTON

FORT McMURRAY

GRANDE PRAIRIE

HINTON

LETHBRIDGE

MEDICINE HAT

PEACE RIVER

RED DEER

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